

(An Autonomous Institution)



DEPARTMENT OF MATHEMATICS

Problems based on the interval (-1,1)

Even function: + 500 10 + 10 = (K)T

A function is said to be even if $f(x) = f(-x) \cdot i \cdot e \cdot, \quad \text{If } f(x) \text{ is an even function}$ $\int f(x) dx = 2 \int f(x) dx$

Odd function :

A function is said to be odd if f(x) = -f(-x) or f(-x) = -f(x) If f(x) is an odd function, $\int f(x) dx = 0$

Note:

If f(x) does not satisfies even and odd function then it is called neither even nor odd function.

Example:

1.
$$f(x) = x^2$$
 in $(-\pi, \pi) - Even$

2.
$$f(x) = x \cos x$$
 in $(-l, l) - odd$

3.
$$f(x) = x \sin x$$
 in $(-\pi, \pi) - Even$

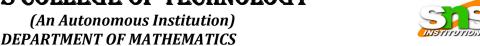
4.
$$f(x) = |x|$$
 in $(-2,2) - Even$

5.
$$f(x) = (l-x)^2$$
 in $(-l,l)$ - Neither even nor

6.
$$f(x) = x + x^2$$
 in $(-\pi, \pi)$ - Neither even nor odd

7.
$$f(x) = x - x^2$$
 in $(-2, 2)$ - Neither even nor odd









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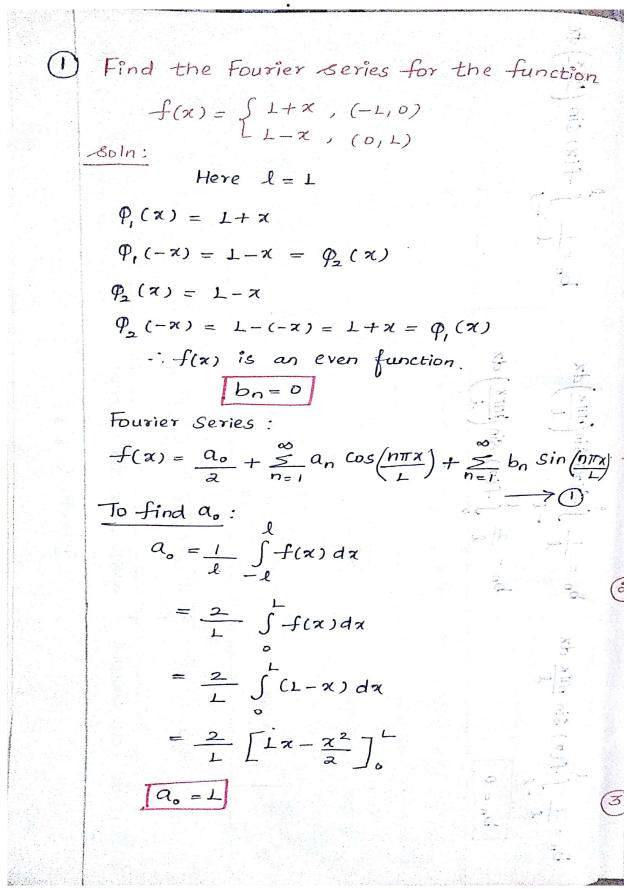


	Interval (-l,l)	
f(n) is an even function	f(x) is an odd function	f(x) is neither even nor od
$f(x) = \frac{a_0}{a} + \frac{x}{n_a}$	$a_n \cos \frac{n\pi x}{\ell} + \sum_{n=1}^{\infty} b_n \sin \frac{n\pi x}{\ell}$	
$=\frac{2}{l}\int_{0}^{l}f(x)dx$	$a_{o} = \frac{1}{l} \int f(x) dx$ $a_{o} = 0$	
Y Y	$a_n = \frac{1}{\ell} \int_{\ell} f(x) \cos \frac{n\pi x}{\ell} dx$ $a_n = 0$	$a_n = \frac{1}{1} \int f(x) \cos mx dx$
$b_n = \frac{1}{l} \int_{-l}^{l} f(x) \sin \frac{n \pi x}{l} dx$ $b_n = 0.$	$b_{n} = \frac{1}{l} \int f(x) \cdot \sin\left(\frac{n\pi x}{l}\right) dx$ $-l$ $b_{n} = \frac{2}{l} \int f(x), \sin\left(\frac{n\pi x}{l}\right) dx$	$b_n = \frac{1}{l} \int_{-l}^{l} -f(\pi) \sin\left(\frac{n\pi x}{l}\right) dx$





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To find
$$a_n$$
:
$$a_n = \frac{1}{L} \int f(x) \cos \frac{n\pi x}{L} dx$$

$$= \frac{\partial}{\partial L} \int_{L}^{L} (L - x) \cos \frac{n\pi x}{L} dx$$

$$= \frac{\partial}{\partial L} \left[\frac{L}{n\pi r} (L - x) \sin \left(\frac{n\pi x}{L} \right) - \frac{L^2}{n^2 \pi^2} \cos \left(\frac{n\pi x}{L} \right) \right]$$

$$= \frac{\partial}{\partial L} \left[\frac{-L^2}{n^2 \pi^2} \cos n\pi + \frac{L^2}{n^2 \pi^2} \cos o \right]$$

$$= \frac{\partial}{\partial L} \cdot \frac{L^2}{n^2 \pi^2} \left[1 - (-1)^n \right]$$

$$a_n = \frac{\partial}{\partial L} \left[1 - (-1)^n \right]$$

$$a_n = \frac{\partial}{\partial L} \left[1 - (-1)^n \right]$$

Subs
$$a_0$$
, a_n and b_n in \mathbb{O} ,
$$f(x) = \frac{L}{2} + \frac{\infty}{n-1} \frac{2L}{n^2\pi^2} \left[1 - (-1)^n\right] \cos\left(\frac{n\pi x}{L}\right)$$

(a)
$$f(x) = |x|$$
 in $-l \le x \le l$.

Soln.

-f(x) is an even function
$$b_n = 0$$

$$a_0 = 1$$

$$a_n = \frac{2!}{n^2 \pi^2} \left[(-1)^n - 1 \right]$$

$$(3) f(x) = |x| \text{ in } -\pi \leq x \leq \pi$$

$$\leq oln$$



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$$f(x) \text{ is an even function}$$

$$b_n = 0$$

$$\alpha_0 = \pi$$

$$\alpha_n = \frac{2}{\pi n^2} \left[(-1)^n - 1 \right]$$

$$\frac{\pi n}{1 + 1}$$

$$\frac{\pi}{1 + 1}$$

$$\frac{\pi}$$

 $f(x) = \frac{2}{\pi n} \frac{4}{\pi n^2} \left[1 - (-1)^n \right] \cos \left(\frac{n\pi x}{n} \right)$



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(5)
$$f(x) = x - x^{2}, -l \leq x \leq l.$$
Soln:
$$f(x) \text{ is neither even nor odd function.}$$

$$f(x) = \frac{a_{0}}{a} + \sum_{n=1}^{\infty} a_{n} \cos \frac{n\pi x}{4} + \sum_{n=1}^{\infty} b_{n} \sin \frac{n\pi x}{2}$$

$$To \text{ find } a_{0}:$$

$$a_{0} = \frac{1}{4} \int (x - x^{2}) dx$$

$$a_{1} = \frac{1}{4} \int (x - x^{2}) \cos \frac{n\pi x}{4} dx$$

$$a_{2} = \frac{1}{4} \int (x - x^{2}) \cos \frac{n\pi x}{4} dx$$

$$a_{3} = \frac{1}{4} \int (x - x^{2}) \sin \frac{n\pi x}{4} dx$$

$$b_{4} = \frac{1}{4} \int (x - x^{2}) \sin \frac{n\pi x}{4} dx$$

$$b_{5} = \frac{1}{4} \int (x - x^{2}) \sin \frac{n\pi x}{4} dx$$

$$b_{6} = \frac{1}{4} \int (x - x^{2}) \sin \frac{n\pi x}{4} dx$$

$$b_{7} = \frac{1}{4} \int (x - x^{2}) \sin \frac{n\pi x}{4} dx$$

$$a_{1} = \frac{1}{4} \int (x - x^{2}) \sin \frac{n\pi x}{4} dx$$

$$a_{2} = \frac{1}{4} \int (x - x^{2}) \sin \frac{n\pi x}{4} dx$$

$$b_{1} = \frac{1}{4} \int (x - x^{2}) \sin \frac{n\pi x}{4} dx$$

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